

**Docket No.: 2328-053**

**PATENT**

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re Application of

Tuqiang NI *et al.*

U.S. Patent Application No. 09/821,753

Filed: March 30, 2001

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Confirmation No. 5171

Group Art Unit: 1763

Examiner: Alejandro Mulero, Luz L.

For: PLASMA PROCESSING METHOD AND APPARATUS WITH CONTROL  
OF PLASMA EXCITATION POWER

**DECLARATION UNDER 37 CFR 1.132**

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Sir:

I, Thomas A. Kamp, hereby declare as follows:

**[0001]** In 2000, I earned, from San Jose State University, a Master of Science Degree (MSE) In Materials of Electronic Devices. My masters degree thesis was entitled "PECVD Undoped Silicon Glass Film in 300 Millimeter Wafers." In 1995, I earned, from San Jose State University, a Bachelor of Science Degree (BS) in Materials Science.

**[0002]** Between 1995 and 2000 I worked for Mattson Technologies on machines for manufacturing semiconductor equipment, particularly machines relating to deposition and stripping of materials on semiconductor wafers.

Between 2000 and the present time, I have been employed by Lam Research Corporation, the assignee of the referenced application, in connection with the development of machines for manufacturing semiconductor equipment, including aspects of such machines for forming features, such as trenches, vias, corners, contacts and lines, on semiconductor wafers. My current title is Senior Staff Process Engineer.

**[0003]** I am one of the patentees of the following four United States Patents:

7,186,661, entitled "Method to Improve Profile Control and N/P Loading in Dual Doped Gate Applications" (attached Exhibit 2);

7, 098, 141, entitled "Use of Silicon Containing Gas for CD and Profile Feature Enhancements of Gate and Shallow Trench Structures" (attached Exhibit 3);

6, 939, 811, entitled "Apparatus and Method for Controlling Edge Depth" (attached Exhibit 4); and

6, 921, 724, entitled "Variable Temperature Processes for Tunable Electrostatic Chuck" (attached Exhibit 5).

All of these patents are concerned, to at least a certain extent, with forming features, including trenches, in semiconductor wafers.

**[0004]** During my employment with Lam Research Corporation I have personal knowledge of rounded corners of trenches of workpieces, in the form of

silicon wafers, being formed in a vacuum plasma chamber. The rounded corners were formed by converting a gas species that was supplied to the chamber into an etchant plasma that was continuously applied to the workpiece while the rounded corners were being formed. While the rounded corners were being formed, the power applied to the etchant plasma was gradually changed. The gradual power change was such that the power did not remain constant for durations in excess of one second while the rounded corners were being formed. While the rounded corners were being formed, in first instances, the following parameters were maintained constant: (1) pressure in the chamber, (2) flow rate of the gas species into the chamber, and (3) species flowing into the chamber. While the rounded corners were being formed in second instances, plasma power was gradually changed as indicated above, and pressure in the chamber was gradually changed while the flow rate of the gas species into the chamber and the species flowing into the chamber were maintained constant. Microphotographs of the rounded corners thus formed in both the first and second instances indicated the rounded corners were smooth without any sign of damaged edges. The smooth rounded corners were formed in both the first and second instances without the necessity for a soft etch being applied after the corners were formed.

**[0005]** I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that the statements were made with the knowledge that willful false statements and the like so made are punishable by fine, or imprisonment,

or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Dated this 9 day of May, 2007, at Fremont, California.

  
Thomas A. Kamp